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DETERMINATION OF METABOLITES FROM THE LEAF OF THE CUBAN GUAYA (MELICOCCUS BIJUGATUS JACQ.) CULTIVATED IN CAMPECHE

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Abstract: The fruit of the Cuban Guaya (*Melicoccus bijugatus* Jacq.) in Campeche, has become a traditional natural snack among families and some entrepreneurs even use it in syrups, popsicles and even in michelada preparations. It is a delight of the Yucatan Peninsula, but it can also be found in Central America and the Caribbean, with names such as mamoncillo, quenepa, Chupalotes, among others.

The results obtained from oven drying, in aqueous extract at room temperature, are: tannins +, flavonoids +, essential oils +, amino acids +, reducing sugars +; in hot aqueous extract they are: tannins +, flavonoids +, essential oils +, amino acids +, reducing sugars +; in ethanolic extract at room temperature they are: flavonoids +, essential oils +, amino acids +, anthocyanidins +, reducing sugars +; in the hot ethanolic extract they are: flavonoids +, essential oils +, amino acids +, reducing sugars +. The presence of flavonoids in the leaf gives it antioxidant action, the primary amino acids share the ability to polymerize with each other to form proteins. It also has essential oils that contribute to antibacterial and antifungal enhancement and reducing sugars that have clinical importance in detecting deficiency of intestinal enzymes such as lactose due to congenital deficiency or nonspecific damage to the mucosa. This information allows this resource to be valued and preserved by those who have it in their yard for the benefits it offers for health.

Keywords: Determination, Screening, Secondary Metabolites, Guaya.

INTRODUCTION

Cuban Guaya (*Melicoccus bijugatus* Jacq.) has been naturalized through cultivation throughout the West Indies, southeastern Mexico, Central America, much of tropical South America, and the Galapagos Islands. It is also grown in warmer areas of temperate zones, such as southern Florida and California (Juárez, 2019).

The tree is slow growing and reaches heights of up to 30 m. The young branches are reddish. The fruit is round, approximately 2.5 cm in diameter, with a thin green shell that comes off easily. Inside it has a large seed, surrounded by a 1 to 2 mm gelatinous substance with a bittersweet flavor, which is the part that is eat (Fuquene, 2018).

The Guaya Cubana tree is tall (up to 25-30 m) but slow growing, it has a wide crown with spreading branches, the thickness of the trunk is around 1.7 m. The fruit is a type of drupe that forms clusters, it is ovoid in shape whose pericarp is strong and bright green. When the fruit is ripe, the pulp acquires a translucent yellow color, it is gelatinous and very juicy, it contains an oval seed of white color (Sánchez, 2020).

Melicoccus bijugatus Jacq. It is a dicotyledonous tree of the Sapindaceae family, also known as the Sapindus family. The fruits of *Melicoccus bijugatus* (Wilson & Bailey, 2020).

They are related to the most commonly known Asian fruit species such as longan (*Dimocarpus Longan* Lam), litchi (*Litchi chinensis* L.) and rambutan (*Nephelium lappaceum* L). (Perez*et al.*,2009).

Flowering takes place from April to May and the fruits ripen in June, extending until September. The fruits (drupes), which grow in groups, have a leathery exocarp (the outside) of green or greenish-yellow color, containing one and occasionally two large seeds, each covered with fibers and a salmon-colored, gelatinous coating (the edible portion)Zulema & Hernández, 2019). They reproduce through seeds and through grafts (Juárez, 2019).

The flowers are small, greenish-white, in clusters 6-10 centimeters long, often in the shape of a terminal panicle, and 5-8 mm wide, with four petals and eight stamens (Fuquene,

2018).

Although fruits are consumed for medical and dietary purposes, research on the phytochemistry of the fruit, especially the secondary metabolites and their associated biological activities, is almost non-existent. Both phenols and sugars have been investigated due to the prevalence of these types of compounds in fruits (Sánchez, 2020).

Regarding medicinal uses, it is necessary to carry out studies on the properties of the fruit, since in Cuban guaya multiple biologically active compounds have been found in the embryo of the seed, especially flavonoids, which are used in the treatment of intestinal infections, fever and sore throat (Rosales et al., 2019).

The extracts of seeds, stems and leaves have been evaluated by analysis tests for the determination of total phenolics, free radical scavenging activity, sugar analysis using Gas Chromatography and antimicrobial analysis against Gram-positive and Gram-negative bacteria, yeasts, *Pseudomona aeruginosa, Bacilus cereus, Staphylococcus aureus, Escherichia coli* and *Candida albicans*, in pulp and seeds, with high free radical activity, total phenols and antimicrobial activity found in the tissue of the seeds and pulp (Juárez, 2019).

A Significant Use Level (NUS) greater than 30% was obtained for *Melicoccus bijugatus* Jacq. (mamoncillo). According to this study, the fruit is the part of the plant that is used to reduce sugar levels. To do this, take the fruit without the peel, boil five seeds in five glasses of water, let it reduce to a glass, consume every six months. According to Orduz & Rangel (2002) the species *Melicoccus bijugatus* Jacq. (mamoncillo) contains tannins which suggests that it could be useful in the treatment of Diabetes mellitus and therefore the perception of improvement by those who use it as therapy for their disease. Other uses: food, astringent, antidiarrheal, wood used for interior decoration (Fuquene, 2018).

One of the ways to publicize the benefits and properties of natural resources is through study in a laboratory known as Phytochemical Screening, to determine the metabolites present, and to understand why guava is not only used as a fruit, But the leaf is also used for its properties, the usefulness is through the knowledge of the elderly people who live in the state who use it for medicinal uses.

METHODOLOGY

To carry out the determination of the metabolites, the techniques from the work carried out by the Ministry of Public Health MINSAP were used.

In carrying out this work, guaya leaves collected in Pomuch, Hecelchakán, Campeche were used; the base raw material was the leaves of the Cuban Guaya plant.

Figure 1 shows the diagram of the process used during the development of this work, where it is observed that the initial sample before drying corresponds to 600 g per sample, from which fractions of 10 g were subsequently taken for each type of extract, whether aqueous or ethanolic, at room temperature (TA *) or hot, respectively.

The techniques for carrying out Phytochemical Screening are mentioned below, they were developed based on the work carried out by the Ministry of Public Health (MINSAP, 1997).

Ferric chloride technique (Phenols and Tannins).

Bornträger test (Quinonas).

Shinoda Method (Flavonoids).

Baljet test (Lactones).

Dragendorff Method (Alkaloids).

Sudan Test (Essential Oils).

Ninhydrin Technique (Free amino acids or amines).

Determination of triterpenes. Libermann-Burchard test (Steroidals and triterpenes).

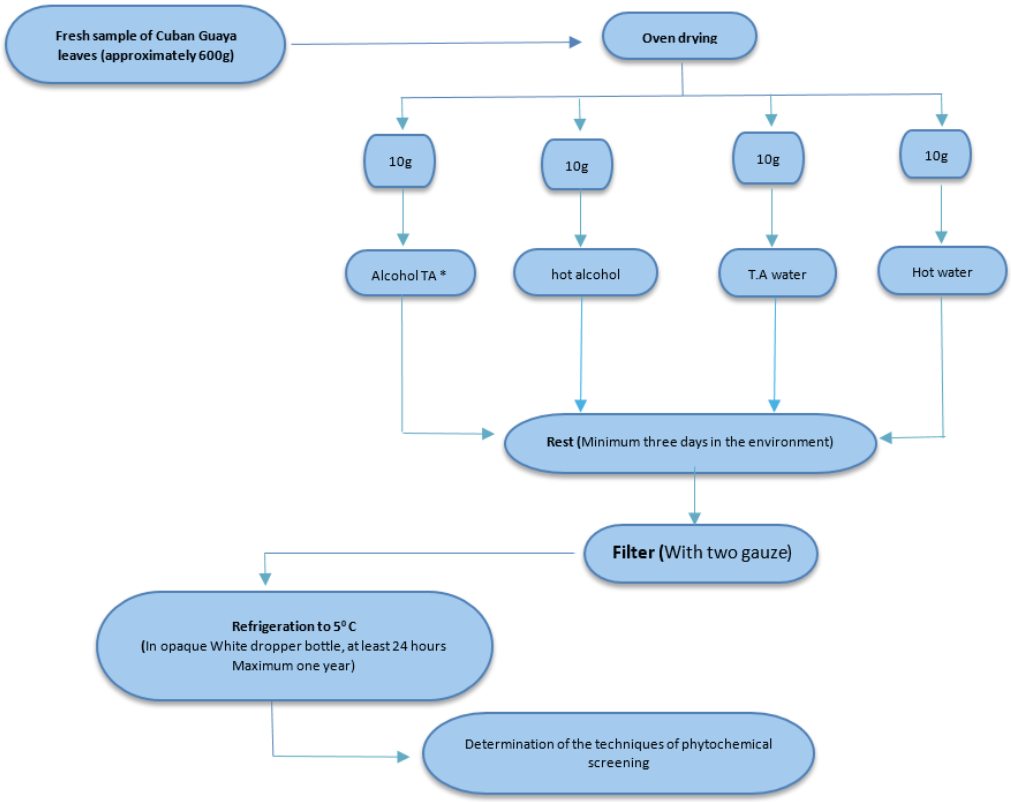

Figure 1. Process diagram

Metabolites	Aqueous Extract Room temperature	Aqueous Extract Hot	Ethanolic Extract Room temperature	Extract Ethanolic Hot
Phenols	-	-	-	-
Tannins	+	+	-	-
Quinones	-	-	-	-
Flavonoids	+	+	+	+
Lactones	-	-	-	-
Alkaloids	-	-	-	-
Essential oils	+	+	+	+
Amino acids	+	+	+	+
Triterpenes	-	-	-	-
Cardiotonic glycosides	-	-	-	-
Anthocyanidins	-	-	+	-
Reducing sugars	+	+	+	+

Table 1 Results of Phytochemical Screening of the Cuban Guaya leaf (Melicoccus bijugatus Jacq.)

Kedde test (Cardiotonic glycosides).
Determination of Anthocyanhydrins.
Fehling test (reducing sugars).

RESULTS

The results obtained from the determination of the Phytochemical Screeningof Cuban Guaya are presented below.

Table 1 presents the results obtained from the Phytochemical Screening carried out on the leaves of Guaya Cubana, in the extraction solvents: water and ethanol, used at room temperature and hot as the case may be.

The presence of Tannins was found in the leaf, of which their properties are recognized in numerous investigations as: antioxidants, anti-inflammatory, anti-ulcer, antibiotic activity, protection and strengthening of the vascular wall, strengthening of the immune system (Vejar et al., 2016). They have the capacity to associate with divalent and trivalent ions and precipitate salts, such as heavy metal salts, Fe3+, Pb, Zn, Cu. Furthermore, they have a beneficial effect on human health, attributed to their antioxidant and anticancer activity (Balasundram et al., 2006).

Flavonoids were also found which, at first, were considered substances with no beneficial action for human health, but later multiple positive effects were demonstrated due to their antioxidant and free radical scavenging action. They play an essential role in protecting against oxidative damage phenomena, and have therapeutic effects in a high number of pathologies, including ischemic heart disease, atherosclerosis or cancer. Its anti-free radical properties are fundamentally directed towards hydroxyl and superoxide radicals, highly reactive species involved in the initiation of the lipid peroxidation chain, and its ability to modify the synthesis of eicosanoids has been described (with anti-prostanoid and anti-inflammatory), to prevent platelet aggregation (antithrombotic effects) and to protect low-density lipoproteins from oxidation (prevention of atheromatous plaque) (Yang et al., 2000).

Due to the presence of essential oils in the leaves, it provides the ability to inhibit the growth of *Candida albicans*, but activity against dermatophytes has not yet been reported. Bystrom and collaborators (2009) observed inhibitory activity of extracts from different tissues of the guaya fruit. Cubana against C. *albicans*, although these authors do not report the difference in biological activity depending on the solvent used, they agree that the biological activity is related to the components extracted by the type of solvent and that these may be specific for each microorganism, in addition, highlight that the presence of certain sugars and phenolic compounds may be the cause of the antimicrobial activity present in the Guaya Cubana fruit.

Amino acids were also found in the leaves of the Cuban Guaya (*Melicoccus bijugatus* Jacq.), whose fruit is usually consumed fresh and occasionally in jelly, cake or cold drinks (Morton, 1987). In Cuba, pulp juice is used for hypertension treatments (Beyra et al., 2004). Research has indicated that the pulp of Guaya Cubana also known as mamoncillo has a high content of amino acids such as riboflavin, thiamine, niacin, ascorbic acid and minerals calcium, phosphorus and iron (Jackson, 1967), as well as a high content of carbohydrates (Pérez et al., 2009), sugars and phenols (Bystrom et al., 2008).

The presence of anthocyanidins was found: chemically, anthocyanins are glycosides of anthocyanidins, that is, they are made up of an anthocyanidin molecule, which is the aglycone, to which a sugar is attached through a β-glucosidic bond. Anthocyanins also play a role in antidiabetic properties such as lipid control, insulin secretion, and vasoprotective

effects (Shipp and Abdel-Aal, 2010). The functional properties of anthocyanins open a new perspective for obtaining colored products with added value for human consumption. These were only found in the ethanolic extract at room temperature.

The presence of reducing sugars in the leaves of the Cuban guava are of relevance since they can detect deficiency of intestinal enzymes such as lactose due to a congenital deficiency or nonspecific damage to the mucosa, and due to their powerantioxidant. (Bystrom et al., 2009), investigated the phenolic activity of reducing sugars, antimicrobial and free radicals in fruit, finding high levels of polyphenols in the fruit pulp through tests such as Ultraviolet Spectroscopy - visible UV - vis, Chromatography gases coupled to Mass Spectrometry (CGEM), antimicrobial activity and Nuclear Magnetic Resonance (NMR). (Bystrom et al., 2012) investigated the possible health effects of *Melicoccus bijugatus* fruit by performing phytochemical and ethnobotanical tests, confirming the presence of polyphenols such as coumaric acid and catechins.

CONCLUSIONS

Finally, the presence of Flavonoids, Essential Oils, Amino Acids and Reducing Sugars was found in Cuban Guaya leaves in all alcoholic extracts, as well as in aqueous extracts at room temperature and at hot temperature. The presence of Flavonoids provides the leaf with antioxidant and free radical eliminating action. They play an essential role in protecting against oxidative damage phenomena, and have therapeutic effects in a high number of pathologies. It contains essential oils which have the ability to inhibit dose-response antibacterial activity, as well as antifungal activity against a species of yeast. The presence of amino acids such as riboflavin, thiamine, niacin, ascorbic acid and minerals calcium, phosphorus and iron used for hypertension treatments and also has reducing sugars that provide it with antioxidant power and its antimicrobial characteristic.

These are some of the pharmacological benefits that the Campechana population takes advantage of when using it, since it is consumed as a seasonal fruit that is part of the cultural acceptance of traditional fruits and can increase adherence to nutritional treatment and greater use of the leaves. It can be a strategy to have benefits, due to its beneficial health properties.

This allows awareness about the cultivation, use and conservation of the resource for the benefits it offers to health, it can be planted in the patio of their homes, it also helps the home economy because it is marketed in the season that nature calls for it. offers.

REFERENCES

Balasundram, N.; Sundram, K.; & Samman, S. (2006). Phenolic compounds in plants and agri-industrial by-products: Antioxidant activity, occurrence, and potential uses. Food chemistry, 99(1), 191-203.

Beyra, A.; León, M.C.; Iglesias, E.; Ferrándiz, D.; Herrera, R.; Volpato, G. (2004). Estudios etnobotánicos sobre plantas medicinales en la provincia de Camaguey (Cuba). Anales de Jardín Botánico de Madrid. 61, 185-204.

Bystrom, L.M.; Lewis, B.A.; Brown, D.L.; Rodríguez, E.; Obendorf, R.L. (2008). Characterisation of phenolics by LC-MS/MS and sugars by GC in Melicoccus bijugatus Jacq. 'Montgomery' fruits. Food Chem. 111, 1017-1024.

Bystrom, Laura M.; Lewis, Betty A.; Brown, Dan L.; Rodríguez, Eloy.; Obendorf, Ralph L. (2009). Phenolics, sugar, Antimicrobial and free radical scavenging activities of Melicoccus bijugatus Jacq. Fruits from the Dominican Republic and Florida.

Bystrom, Laura M.; Lewis, Betty A.; Brown, Dan L.; Rodríguez, Eloy.; Obendorf, Ralph L. (2012). The potential health effects of Melicoccus bijugatus Jacq. fruits: Phytochemical, chemotaxonomic and ethnobotanical investigations.

Fuquene Peña, Y. V. (2018). Uso de plantas para el manejo de las enfermedades prevalentes en San Andrés de Tumaco en el Pacífico Colombiano y su posible implementación como tratamiento primario (Doctoral dissertation).

Jackson, G.C. (1967). Promising Selection of Honeyberry (Melicoccus bijugatus L) from Puerto Rico. The J. Agri. University of Puerto Rico. 51(1).

Juárez Méndez, M. E. (2019). Influencia del tipo de solvente y la concentración del extracto de melicoccus bijugatus sobre películas antimicrobianas de quitosano-almidón.

López, J. C. C.; Sachdev, H.; Thepanondh, S.; & Herrera, Y. A. Q. (2021). Morphological and Physico-Chemical Characterization of Fruit of Melicoccus Bijugatus Jacq. Bangladesh Journal of Botany, 50(2), 387-394.

Ministerio de Salud Pública MINSAP. (1997). Guía metodología para la investigación en plantas medicinales. La Habana: Pueblo y Educación. Cuba.

Morton, J. F. (1987). Fruits of Warm Climates. Published by Julia Morton. Miami, Florida, EUA.

Orduz, J. O.; & Rangel, J. A. (2002). Frutales tropicales potenciales para el piedemonte llanero.

Pérez, H.; Gómez, M.; Vila, J. (2009). Composición físico-química y nutricional del fruto de mamoncillo (*Melicoccus bijugatus* Jacq.) según su ubicación en el árbol. Agrollanía (6), 39-44.

Rosales, M. P.; Jiménez, R. E.; Ramos, M. O. A., Hernández, B. M. T., García, O. F., Salgado, C. M. P., & López, C. M. S. (2019). Phenolic compounds in the pulp, pericarp and seeds of Litchi (Litchi chinensis Sonn.) in different stages of maturation. Nutr Food Sci Int J, 8(3).

Sánchez, C. P. (2020). Evaluación del efecto modulador de glucosa de cáscaras de saramuyo (Annona squamosa L.) y huaya (*Melicoccus bijugatus* Jacq.) en ratas sanas y en un modelo de diabetes tipo 2.

Shipp, J.; & Abdel-Aal, E. S. M. (2010). Food applications and physiological effects of anthocyanins as functional food ingredients. The open food science journal, 4(1).

Vejar, A. G.; Tolosa, B.; Parra, J. W.; & Rodríguez-Ordoñez, D. C. (2016). Uso de la cáscara de mamón (Melicoccus bijugatus) para el teñido de telas. Avances en Química, 11(3), 123-128.

Wilson, J.; Goldson-Barnaby, A.; & Bailey, D. (2020). Melicoccus Bijugatus (guinep): Phytochemical Properties, Associated Health Benefits and Commercial Applications. International Journal of Fruit Science, 20(4), 659-666.

Yang K, Lamprecht SA.; Liu Y. y cols. (2000). Chemoprevention studies of the flavonoids quercetin and rutin in normal and azoxymethane-treated mouse colon. Carcinogenesis, 2000, 21:1655-1660.

Zulema, M.; & Hernández, V. (2019). Frutas del plato tradicional maya como potenciales alimentos funcionales. Revista Medicina, 6(3), 70–77.